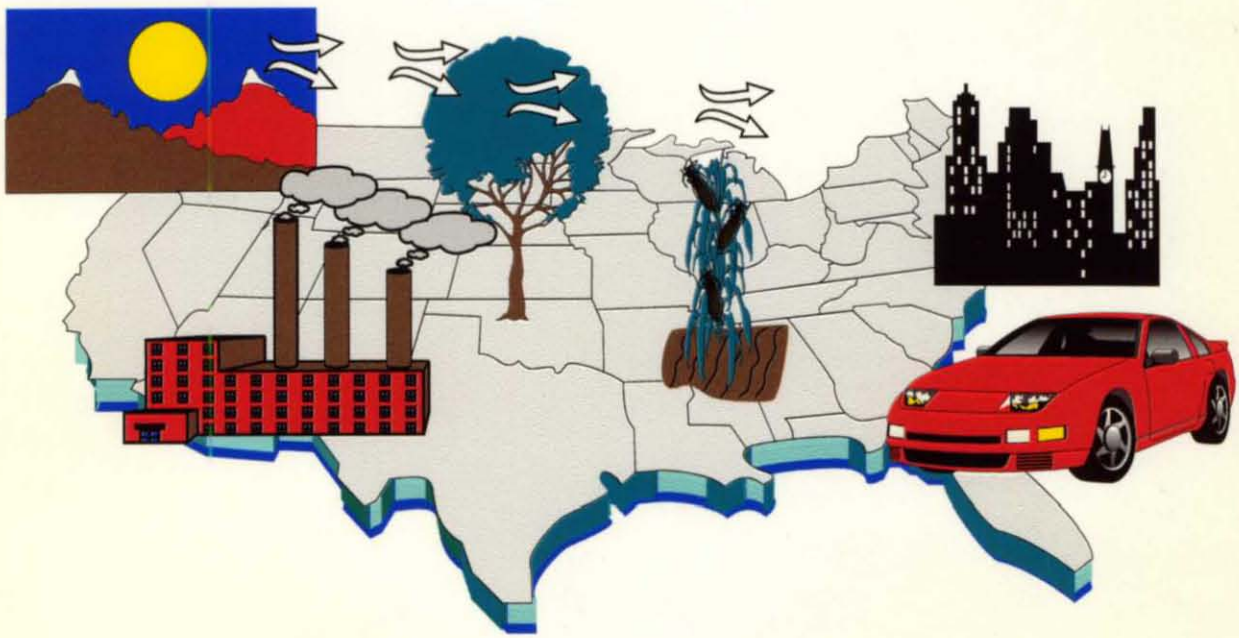
****EXECUTIVE SUMMARY****

NATIONAL AIR QUALITY WORKSHOP

SCIENTIFIC BASIS AND PUBLIC POLICY RATIONALE FOR AIR QUALITY STANDARDS IN THE UNITED STATES: OHIO AND THE MIDWESTERN REGION



THE OHIO STATE UNIVERSITY

COLUMBUS, OHIO

30 JUNE 1997

THIS COMMUNITY-RELEVANT WORKSHOP ON AIR QUALITY WAS SUPPORTED BY THE BYRD POLAR RESEARCH CENTER AND THE OFFICE OF RESEARCH AT THE OHIO STATE UNIVERSITY IN COLLABORATION WITH THE DIVISION OF AIR POLLUTION CONTROL AND THE OFFICE OF ENVIRONMENTAL EDUCATION AT THE OHIO ENVIRONMENTAL PROTECTION AGENCY.

AIR QUALITY WORKSHOP - ADVISORY GROUP

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1. SUMMARY OBSERVATIONS AND RECOMMENDATIONS

On 5-6 June 1997, The Ohio State University convened a national workshop on the *Scientific Basis and Public Policy Rationale of Air Quality Standards in the United States: Ohio and the Midwestern Region.* This air quality workshop involved over 175 participants from 14 states, more than 30 different industries, 15 special interest groups and 7 universities in collaboration with local, state and federal agencies. Beyond an academic exercise, this air quality workshop united diverse stakeholders and perspectives under the broad umbrella of sustainable development - with its intertwined objectives of economic prosperity, human health, social equity and environmental protection (Figure 1).

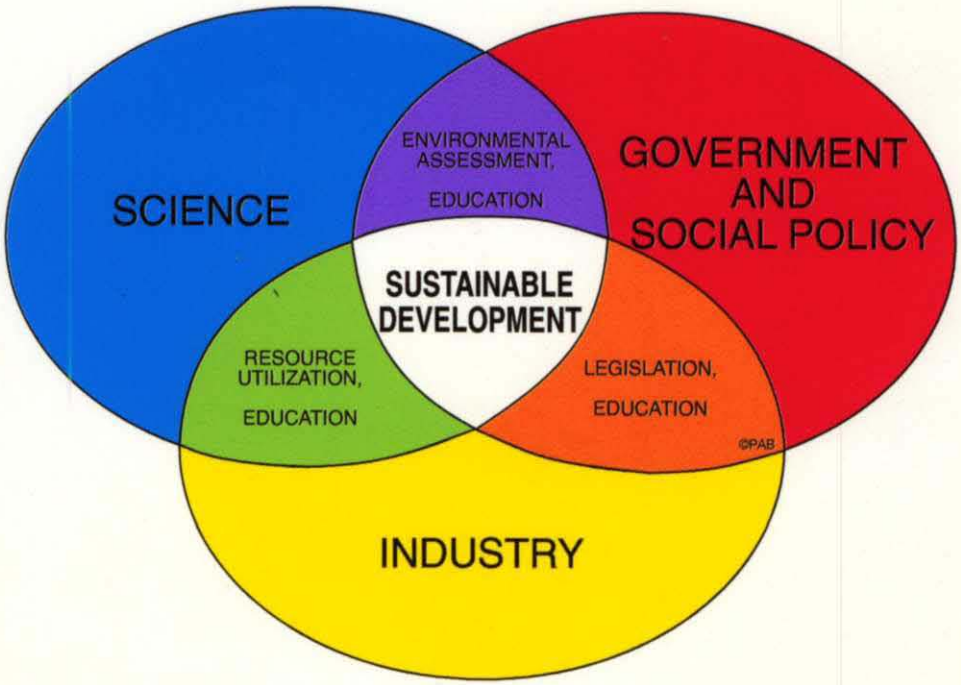


FIGURE 1: Community partnerships that integrate science, industry, governm ent and social policy perspectives for our sustainable development.

At the heart of this workshop was the community partnership that was forged with the University, Ohio Environmental Protection Agency, Columbus Health Department, American Electric Power, Public Utilities Commission of Ohio and the United States Geological Survey. It was through this community partnership that the vision for the workshop was created and realized. In itself, this collaboration demonstrates the feasibility of implementing sustainable development strategies at the community level.

To address the complex issues of air quality in a forward-looking manner - community leaders from universities, federal and state agencies, private corporations and institutions were invited to share their insights in objective discussions about the national air quality standards for ozone and particulate matter in the lower atmosphere. The challenges of this workshop were to:

(1) consider the underlying scientific data and models that are involved in developing and implementing the national standards.

(2) build on substantive collaborations such as those of the Ozone Transport Assessment Group (OTAG).

To meet these challenges, the first session focused on chemistry as the underlying feature of air quality. After discussing the natural and anthropogenic sources and photochemical processes that influence atmospheric composition, the second session focused on the transport of the various chemical constituents. The third session then considered the epidemiology of how these air-borne chemicals influence human health. In the final session, the scientific perspectives were considered together with the broader social interests to address the establishment and implementation of national air quality standards at the community level.

Each session involved keynote presentations followed by a panel discussion which included responses to questions from the audience. At the end of each session, the panelists were asked to identify the outstanding scientific and technical questions with policy relevance that remain to be answered. These objective questions from the panelists and audience have been compiled (**QUESTIONS FOR IMPLEMENTING AIR QUALITY STANDARDS**) for community leaders who are designing and implementing sustainable air quality strategies for our nation.

OBSERVATION 1: Universities are strongholds of objectivity that can serve our communities by bringing together diverse stakeholders to objectively discuss community-relevant issues, as demonstrated by this air quality workshop at The Ohio State University.

RECOMMENDATION 1: Universities across the United States should enhance their outreach to foster community partnerships that integrate scientific, economic, government and social policy perspectives related to sustainable development issues - including air quality which affects humans from local to global scales.

RECOMMENDATION 2: The Ohio State University should build on the progress of this air quality workshop by facilitating discussions among diverse community stakeholders that contribute to the effective implementation of air quality standards in the midwestern region of the United States.

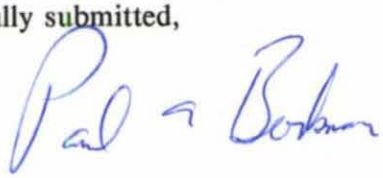
OBSERVATION 2: The design of our national air quality standards is based on credible human health criteria while the effective implementation of these standards across the nation will involve other considerations, including: costs and benefits, technological innovations, multi-component management strategies, comprehensive and well-controlled research designs, and regional environmental diversity.

> *RECOMMENDATION 3: The United States should develop a chemical climatology database and forecasting system that is complementary in scope and application to current meteorological forecasting.*

> *RECOMMENDATION 4: The midwestern states, which occupy a relatively flat area with vast agriculture in the center of the continent, should coordinate a midwestern regional research and air quality implementation strategy. This strategy should include the extensive network of farms and statewide farm bureaus in the midwest to facilitate air-quality comparisons between rural and urban areas. These data are important on a national level for understanding the natural and anthropogenic sources and processes that affect air quality.*

The above observations and recommendations have been distilled from the workshop discussions and comprehensive list of questions that were keenly asked by the invited speakers, panelists and members of the audience. These questions, which reflect the vision and results of the workshop, are listed below (please see **QUESTIONS FOR IMPLEMENTING AIR QUALITY STANDARDS**). For additional information regarding the workshop and progress with upcoming reports, please see the web site at the Byrd Polar Research Center at The Ohio State University (**http:\\www-bprc.mps.ohio-state.edu**).

Respectfully submitted,



Paul Arthur Berkman, Ph.D.
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Workshop Convener

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2. QUESTIONS FOR IMPLEMENTING AIR QUALITY STANDARDS

CHARGE TO THE WORKSHOP
OPENING ADDRESS
DIRECTOR DON SCHREGARDUS

1) What types of monitoring activities are necessary to collect the appropriate data on health, transport and ecological impacts associated with air chemistry?

2) What are the strengths and weaknesses of the scientific tools and measurements that are available to predict ozone and particulate matter? How could the accuracy of these tools be improved?

3) What are the strengths and weaknesses of the current process for setting air quality standards? How should this process be refined? How should resources be allocated?

4) What are the key public policy issues for setting standards (e.g. cost and technical feasibility)?

5) What are the expected health benefits from implementing a variety of environmental strategies?

6) How should we build on this conference to move us forward on a national level?

7) What is the best forum for continuing these types of community-relevant discussions?

SCIENTIFIC BASIS - CHEMISTRY (PANEL)

1) What are the interacting processes between particulate matter and ozone?

2) What is the long-term impact of air pollutants on agriculture?

3) What is the role of aqueous-phase and heterogenous photochemistry in oxidant production?

4) If a variety of control strategies are indicated (process studies) for different flow regimes, under different temperature and photochemical conditions, is it feasible to respond in a sufficiently robust manner to maintain attainment?

5) What are the $PM_{2.5}$ conditions in urban areas today?

6) Are urban and rural sources and dynamics of $PM_{2.5}$ similar or different?

7) What are the "unmanageable" levels of ozone and particulate matter relative to the standards?

8) What is the mechanism for developing regional strategies?

SCIENTIFIC BASIS - CHEMISTRY (PANEL)

(cont'd.)

9) How is indoor air quality related to outdoor monitoring of oxidants and particulate matter?

10) What is the relative importance of volatile organic compound or nitrogen oxide emissions on rural v. urban air quality?

11) Can rural areas ever attain the new United States Environmental Protection Agency (USEPA) levels of ozone and particulate matter?

SCIENTIFIC BASIS - CHEMISTRY (AUDIENCE)

1) How are land-use patterns in the natural environment related to the increase in background ozone?

2) Do available nitrogen oxides (NOx), volatile organic compounds (VOC), ozone and particulate monitors have the necessary spatial and temporal resolution to validate the models? If not, how should the monitors be improved?

3) Monitoring capabilities, available data and chemical models all seem to have significant gaps. For this reason, are the proposed air quality standards premature?

4) What portion of $PM_{2.5}$ is the result of mobile sources?

5) Since successful implementation of "public" compliance requires gaining the social and political will of the taxpayer, what are the key data necessary to gain the "political" backing of the general population?

6) Should we start to make NOx reductions, knowing that it will increase urban ozone, if it will decrease rural or background ozone?

7) How are different particulate matter forms inhaled and what is the response of the average person - (i.e. "deep lung" v. "coughable")?

8) What are the impacts of ozone controlling strategies on the $PM_{2.5}$ controlling strategies? From an atmospheric chemistry perspective, what is the optimum multi-pollutant controlling strategy?

9) How can we employ cost-benefit analyses to enhance the implementation of clean air standards?

10) As the EPA used studies of Philadelphia as support for $PM_{2.5}$ health effects, are we really looking at a regional problem or a data collection anomaly?

11) Because ozone interacts with NOx, what impact does rising ozone have on the nitrogen cycle? Also, how might the use of ground fertilizer (N_2 cycle) impact the ozone level?

SCIENTIFIC BASIS - CHEMISTRY (AUDIENCE)

cont'd.

12) How should the ozone precursor monitoring programs be conducted in light of the possible changes in the ozone standard?

13) Is there a way to quantify costs of learning enough about the chemistry and physics as well as the appropriate monitoring of air pollution?

14) What kind of rational investment is needed to accurately measure emission rates of $PM_{2.5}$ from the myriad sources that emit particulate matter?

15) How should the number, location and overall selection of rural and urban monitoring sites be conducted?

16) At rural sites, what should we be monitoring in addition to ozone?

17) How important is it to supplement fixed monitoring sites with "mobile" measurements (ground and aircraft)?

18) With the US industry moving to Central America and Mexico with less regulations and standards for emissions, how does the US deal with the particulate matter and ozone emissions that enter the country?

19) How attainable are "background" or natural levels of particulate matter and ozone?

20) What problems arise in measuring $PM_{2.5}$ from the tendency of particles of this size to clump/cluster/aggregate?

21) If isoprenes/turpenes are the chief components that form rural ozone, how can the National Ambient Air Quality Assessment (NAAQA) be adjusted to account for this effect?

22) Do the monitors for $PM_{2.5}$ collect and measure all constituents equally well or is there a bias for collecting sulfates and nitrates better than hydrocarbons?

23) Do we have the technology, experimental designs and models in place to monitor the proposed standards for ozone and particulate matter?

SCIENTIFIC BASIS - TRANSPORT (PANEL)

1) What is the linkage between regional, local and continental scale transport?

2) What is the most equitable strategy for sharing in the implementation of control strategies?

SCIENTIFIC BASIS - TRANSPORT (PANEL)

cont'd.

3) How should the transport models be improved to reduce the uncertainties associated with biogenic sources and meteorology?

4) What new modeling tools are needed for the future?

5) Models assume constant environmental conditions into the future, what is the role of climate change?

6) How do we address attainment where transport is an insignificant contribution?
7) Can the USEPA do a more situation-oriented analyses of the chemistry/health affects?

8) How do we reduce the uncertainties in the models associated with meteorology, different sources, estimated emission inventories and chemical processes?

SCIENTIFIC BASIS - TRANSPORT (AUDIENCE)

1) If impacts fall off with distance, what was the basis for the vote to recommend to USEPA to require 85% reductions in NOx below 1990 levels?

2) Would it not appear from the isoprene/formaldehyde model maps that forests are the prime contributors to ozone non-attainment? Why or why not?

3) What fraction of the time is the Midwest and significant source region for the northeastern United States?

4) What are the uncertainties associated with the model results?

5) If NOx reductions are more significant than VOC reductions in reducing ozone, and that ozone transport effects may suggest regional solution, is the current emphasis on vehicle emissions testing (i.e. to reduce VOC's) as an air pollution control measure appropriate?

6) Will regional implementation plan replace state implementation plans?

7) To what extent would reduction in ozone or particulate matter in a limited area be expected to result in lower local and regional levels of these pollutants?

8) How will deregulation of the energy industry in the Midwest impact ozone levels in the northeast?

SCIENTIFIC BASIS - TRANSPORT (AUDIENCE)

cont'd.

9) How is pollutant reduction geographically-dependent?

10) How cooperative are the States appearing to be in implementing the proposed USEPA standards?

11) How much does the transport of ozone influence downwind non-attainment?

SCIENTIFIC BASIS - EPIDEMIOLOGY (PANEL)

1) What are the mechanisms, epidemiology and toxicological mechanisms that are associated with particulate matter and ozone impacts at the cellular and tissue level?

2) How should land use and demographic factors be considered in the interpretation of epidemiology?

3) What are the specific components associated with particulate matter that adversely affect human health?

4) Based on past standards, what are the measured benefits to improve public health and are we regulating the air impacts correctly?

5) How can we improve individual/personal level exposures from a toxicological perspective?

6) Can we afford to wait for adequate scientific information to respond to a perceived public health concern?

7) Do we have adequate scientific information to identify the specific health impacts and how to resolve them in a sustainable manner?

8) What are the associations between regulated air constituents, general living conditions, ambient environmental conditions and specific health responses?

9) What are the specific air components that are most responsible for pulmonary and cardio-vascular responses?

10) How should we assess the interactions among pollutants simultaneously to disentangle their impacts?

11) What is the real shape of the dosage-response curve?

SCIENTIFIC BASIS - EPIDEMIOLOGY (AUDIENCE)

1) Daily mortality and PM10 concentrations show a statistically significant relationship to respiratory deaths. What does PM2.5 research show about this relationship?

2) What are the best available sources of particulate matter and ozone health studies conducted for specific sites?

3) What is the relationship between indoor particulate matter and outdoor particulate matter, where the measurements are being made?

4) Has there been any study comparing premature or additional deaths due to poverty or joblessness compared to death associated with pollutants?

5) How does the level of health risks from pollution compare with risks from other factors?

6) If pre-existing conditions make people more susceptible to particulate matter health effects, is there any merit to addressing the pre-existing conditions and their causes?

7) When will the data from the "Six-Cities Study" (includes Steubenville, OH as the most impacted site) be made available to other researchers for peer review?

8) In a New York Times article last week, Carol Browner suggests that there is no new information available that would change EPA's proposal. Aren't there any new studies that appear to be relevant to the development of clean air act regulations? Is EPA moving too fast?

9) Given the complexity and uncertainties associated with establishing clean relationships between particulate matter, morbidity and mortality, what experimental strategies (technology, measurement intercomparisons, subject involvement) do you recommend to resolve these questions?

10) How do you remove the meteorological effect from the health risk data?

ESTABLISHING AIR QUALITY STANDARDS (PANEL)

1) How can we develop multi-component management strategies?

2) How can we develop a chemical climatology database?

3) What would be the optimal framework for establishing a regional monitoring scheme that includes urban and rural areas?

4) Can be develop a methodology for decision-making to reach optimal solutions?

5) How can we improve the design of systems energy research and sustainable technology?

6) How should we involve various stakeholders in developing a positive approach?

ESTABLISHING AIR QUALITY STANDARDS (PANEL)

cont'd.

7) How can we make the regulatory framework "smarter" to create affordable improvements?

8) How can we improve our understanding of the role and responsibilities of the regulatory agency?

9) At what point does the regulatory function become a political action function?

10) How is the regulatory process related to targets and costs?

11) How do we establish a cost burden that is acceptable to diverse sectors the public?

12) How do we get the public media to report accurately, effectively and fairly so we can engage in this public debate without playing on public fears?

13) How do we gain understanding about the relationships and progressive influence from sources to exposures to dosages to critical health impacts?

14) What are the steps that should be taken in implementing new standards?

15) How do we improve the feedback between risk research, assessment and management?

ESTABLISHING AIR QUALITY STANDARDS (AUDIENCE)

1) Given that the major sources of particulate matter are not anthropogenic, what is the feasibility of placing the greatest burden on industry whose contribution is less than 10%?

2) We have heard that the ambient air quality has increased over the past 20 years. We also have heard that the current data and scientific studies fall short in allowing for adequate assessment of the issues (especially PM2.5). Doesn't it appear that the proposed standards are being driven by the litigation and potential litigation by special interest groups in the name of public health?

3) Is it the duty of the EPA to consider factors such as the erosion of political faith, public skepticism and economic damage in the decision-making process?

4) Is there a catch-22 that the public will never support funding for data collection to establish a scientific basis for pollution standards? Who else has the incentive to collect the underlying data?

5) Since EPA is compelled by law to protect human health and environmental quality with a sufficient margin of safety, would not EPA be remiss in their duties if they were not to promulgate the PM2.5 standard as the epidemiology data indicate they should?

6) How far does EPA have to go? Is the agency required to look for the most sensitive individual and put standards into effect to protect that individual with an adequate margin of safety without regard to cost?

ESTABLISHING AIR QUALITY STANDARDS (AUDIENCE)

cont'd.

7) If cars already have been regulated to the point where their emission impacts are minimal, how can/should transportation impacts be further reduced?

8) Different regions of the country may face public health issues that differ in relative importance. In fact, many people would argue that the United States is too large and diverse for one-size-fits-all solutions to be optimal. Is feasible to promulgate national standards on a limited number of public health issues that may force locales to divert resources from their most pressing public health concerns?

9) Should we move toward an integrated approach to public health, in which a standard of public risk is set, then the EPA assists regions in identifying their priorities and strategies for addressing them?

10) Since we are no longer assuming a "bright line" for health effects between a PM10 and PM2.5 standard, on what bases were the proposed levels established? Moreover, at any level above zero impact are we not leaving some sensitive persons unprotected?

11) Where does an adequate margin of protection fall on the following continuums: morbidity (from biomarkers through death), uncertainty, sensitivity (genetic and acquired by individuals)?

12) What is the relationship between the number of deaths, economic status (e.g. unemployed), living conditions (e.g. rural v. urban), and the proposed particulate matter and ozone standards?

13) Emissions have been on a decline for PM10, sulfates, nitrates and ozone for many years. The incidence of asthma in children has dramatically increased in the past several years. Why does EPA continue to link this increase in asthmatic children to emissions?

14) Could computer models be scaled down to find potential violations within a city? How many sensors/monitors are needed to accurately assess such local impacts?

15) Model results from the Ozone Transport Assessment Group (OTAG) show a decrease in 'northeastern corridor' ozone concentrations around 2-6 parts per billion by volume when emissions are reduced by 55-75% in NOx in the Midwest. How robust is this result and is the model accurate to the level of 2 ppbv? Is a 2ppbv reduction worth spending billions of dollars? How should policy-makers use this result?

16) How are national regulatory strategies going to be implemented in a manner which is not biased on a regional basis?

17) As strongholds of objectivity, can universities be honest brokers to affect sustainable development in our communities?

18) How do we develop sustainable partnerships between universities, government, local community organizations, special interest groups, industry and private corporations?

ESTABLISHING AIR QUALITY STANDARDS (AUDIENCE)

cont'd.

19) Should a fixed percentage of federal research funding for environmental protection be allocated to universities for intercomparisons and independent research designs?

20) What is/should be the role of science in policy-making?

21) How do we determine what is the best allocation of resources and appropriate design of regulatory strategies for resolving a variety of environmental impacts?

22) How do cost-benefit analyses take into consideration the value of human health and the cumulative costs/benefits to communities?

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3. WORKSHOP SCHEDULE OF SPEAKERS AND PANELISTS

THURSDAY, 5 JUNE 1997

INTRODUCTION

8:30-8:45 AM — Convener: Dr. Paul Berkman (Science-Policy Coordinator - Byrd Polar Research Center, Ohio State University)

OPENING ADDRESS

8:45-9:30 AM — Speaker: Mr. Don Schregardus (Director - Ohio Environmental Protection Agency)

PANEL 1: SCIENTIFIC BASIS - CHEMISTRY

9:30-9:50 AM — Speaker: Dr. William Chameides (Professor - Earth and Atmospheric Science, Georgia Institute of Technology)

9:50-10:10 AM — Speaker: Dr. Mary Anne Carroll (Professor - Atmospheric, Oceanic and Space Science; University of Michigan)

10:10-10:30 AM — Speaker: Dr. George Hidy (Professor - Civil and Environmental Engineering, University of Alabama)

10:30-10:45 AM — BREAK

10:45-11:30 AM — Panel Discussion (Speakers and Panelists)

Moderator: Dr. Franklin Schwartz (Ohio Eminent Scholar and Professor - Geological Sciences, Ohio State University)

Panelist: Dr. Chris Hadad (Professor - Chemistry, Ohio State University)

Panelist: Dr. John Hall (Assistant Vice President for Research - Ohio State University)

11:30-12:00 PM — Open Discussion with Audience

12:00-1:30 PM — LUNCH

THURSDAY, 5 JUNE 1997 (cont'd.)

PANEL 2: SCIENTIFIC BASIS - TRANSPORT

1:30-1:50 PM	Speaker: Mr. Mike Koerber (Technical Director - Lake Michigan Air Directors Consortium)
1:50-2:10 PM	Speaker: Mr. Ralph Morris (Senior Manager - ENVIRON Corporation)
2:10-2:30 PM	BREAK
2:30-3:30 PM	Panel Discussion (Speakers and Panelists)
	Moderator: Dr. Keith Bedford (Professor and Chair - Civil and Environmental Engineering, Ohio State University)
	Panelist: Dr. David Bromwich (Senior Scientist - Byrd Polar Research Center, Ohio State University)
	Panelist: Mr. Robert Hodanbosi (Chief - Division of Air Pollution Control, Ohio Environmental Protection Agency)
	Panelist: Dr. Robert Imhoff (Atmospheric Modeler - Tennessee Valley Authority)
	Panelist: Dr. Richard Lahiere (Senior Manager - Environmental Health and Safety, Honda of America Manufacturing)
	Panelist: Mr. John McManus (Manager - Environmental Strategy and Planning, American Electric Power)
3:30-4:00 PM	Open Discussion with Audience

RECEPTION

4:00-5:30 PM	Wexner Center for the Arts, Mershon Auditorium

FRIDAY, 6 JUNE 1997

KEYNOTE ADDRESS

9:00-9:30 AM	Speaker: Mr. Dave Guinnup (Office of Air Quality Planning and Standards, United States Environmental Protection Agency)

PANEL 3: SCIENTIFIC BASIS - EPIDEMIOLOGY

9:30-9:50 AM	Speaker: Dr. Douglas Dockery (Professor - Environmental Epidemiology, Harvard)
9:50-10:10 AM	Speaker: Dr. Ronald Wyzga (Manager - Air Quality, Health and Risk Assessment; Electric Power Research Institute)
10:10-10:30 AM	BREAK

FRIDAY, 6 JUNE 1997 (cont'd.)

PANEL 3: SCIENTIFIC BASIS - EPIDEMIOLOGY

10:30-11:30 AM Panel Discussion (Speakers and Panelists)

Moderator: Dr. Martin Keller (Professor Emeritus - School of Public Health, Ohio State University)

Panelist: Dr. James Allen (Professor - Internal Medicine, Ohio State University)

Panelist: Dr. Deborah Gray (Senior Toxicologist - Metcalf and Eddy)

Panelist: Dr. Douglas Way (Professor - Landscape Architecture, Ohio State University)

Panelist: Dr. Donn Young (Director - Biostatistics, James Cancer Center)

11:30-12:00 PM Open Discussion with Audience

12:00-1:30 PM LUNCH

PANEL 4: ESTABLISHING AIR QUALITY STANDARDS

1:30-1:50 PM Speaker: Mr. William Jones (Environmental Scientist - Region 5, United States Environmental Protection Agency)

1:50-2:10 PM Speaker: Dr. Roger McClellan (President and Chief Executive Officer - Chemical Industry Institute of Toxicology)

2:10-2:30 PM Speaker: Rep. William Schuck (Chair, Environment and Energy Committee - State of Ohio House of Representatives)

2:30-2:50 PM BREAK

2:50-4:00 PM Panel Discussion (Speakers and Panelists)

Moderator: Dr. Ken Jezek (Director - Byrd Polar Research Center, Ohio State University)

Panelist: Dr. Kenneth Chilton (Director - Center for the Study of American Business, Washington University)

Panelist: Dr. Edward Hayes (Vice President for Research - Ohio State University)

Panelist: Dr. C.S. Kiang (Professor - Earth and Atmospheric Science, Georgia Institute of Technology)

Panelist: Dr. Alan Randall (Professor - Agricultural Economics, Ohio State University)

4:00-4:30 PM Open Discussion with Audience

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